Studies of Triton and the Pluto-Charon System

Institute for Astronomy, University of Hawaii

David J. Tholen

Strategy

This project is designed to take advantage of the six-year-long series of mutual occultation and eclipse events involving Pluto and its satellite Charon during one of its rare edge-on orbital alignments. High-precision, high-time-resolution photometry of these events, each of which displays a unique geometry of the system, can be utilized to extract several important physical parameters, including the relative sizes of the two bodies, the orientation of the orbit of the satellite, and the surface albedo distribution on one hemisphere of each object. An important derived parameter is the mean density of the system, which constrains the bulk composition of the two bodies.

Progress and Accomplishments

1990 was the final year of events, with the last event occurring on 1990 October 15 UT. Prior to opposition, grazing geometry involving only the shadows of the two objects produced very shallow events of less than five percent in maximum depth, decreasing as Pluto approached opposition. Following opposition, parallax produced overlap of the two projected disks, and the events reached a maximum depth of nine percent (in blue light) near the time of postopposition quadrature. Opposition represented a time of last contact for the events involving shadows and first contact for events involving disks and thus offered an opportunity to perform very sensitive edge detection observations. During 1990, six events were well observed with the 2.24-m telescope on Mauna Kea, and two additional events, partially damaged by adverse weather conditions, contain some useful data. In particular, a five-hour-long observation near opposition yielded photometric resolution of 0.0025 magnitudes per 72 second integration, thereby providing a significant constraint on the sizes of the two bodies.

Projected Accomplishments

Work in 1991 will be devoted primarily to establishing photometric baselines at the two rotational phases corresponding to the events, thus enabling interpolation to be used to determine the expected unocculted or uneclipsed brightness of the system that can be differenced with the measured brightness during an event, which in turn goes into the surface albedo mapping effort. Also, a systematic rereduction of the data obtained throughout the mutual event season will begin with an analysis of the long term photometric behavior of the comparison stars used for the last nine years. Our goal is to produce a network of comparison stars whose brightnesses and colors have an internal consistency approaching

0.001 magnitudes, thereby minimizing any degradation of the Pluto data from systematic errors in the comparison star magnitudes.

No new work on Triton was performed during 1990, nor is any anticipated for 1991. Prior observations were obtained primarily to support the Voyager 2 encounter with the Neptune system, which occurred in 1989.

Publications

No new papers were published in scientific journals during calendar year 1990, although a popular level summary article was published.

Tholen, D. J. 1990. Pluto. *McGraw-Hill Yearbook of Science & Technology 1991*, pp. 334-336. McGraw-Hill, New York.